



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : B32B 31/28, G01J 1/08	A1	(11) International Publication Number: WO 00/26029 (43) International Publication Date: 11 May 2000 (11.05.00)
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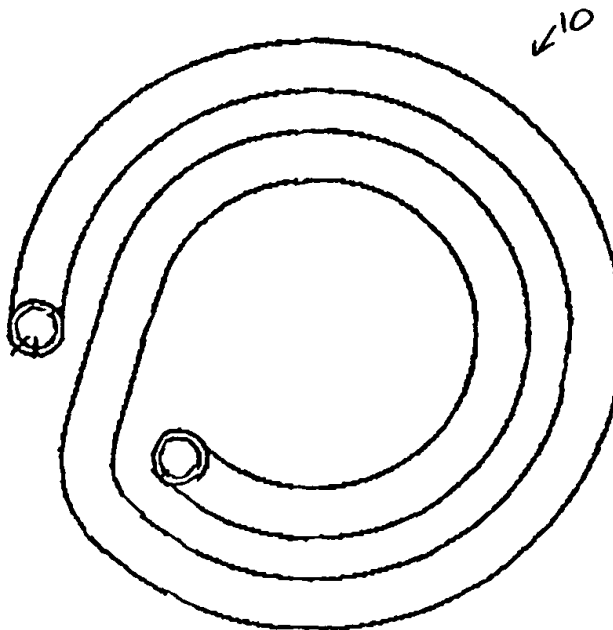
(21) International Application Number: **PCT/US99/26188**(22) International Filing Date: **4 November 1999 (04.11.99)**(30) Priority Data:
60/107,057 **4 November 1998 (04.11.98)** **US**(63) Related by Continuation (CON) or Continuation-in-Part (CIP) to Earlier Application
US **60/107,057 (CIP)**
Filed on **4 November 1998 (04.11.98)**(71) Applicant (for all designated States except US): **XENON CORPORATION [US/US]; 20 Commerce Way, Woburn, MA 01801 (US).**

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(75) Inventor/Applicant (for US only): **PANICO, Richard, C. [US/US]; Medford, MA 02155 (US).**(74) Agents: **DIENER, Michael, A. et al.; Hale and Dorr LLP, 60 State Street, Boston, MA 02109 (US).**(81) Designated States: **AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).****Published***With international search report.**Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.*(54) Title: **A SPIRAL-SHAPED LAMP FOR UV CURING OF COATINGS AND BONDING FOR A DIGITAL VERSATILE DISK (DVD) OR COMPACT DISK (CD)**

(57) Abstract

A spiral-shaped lamp (10) is used for disk manufacturing processes, such as curing of coating or bonding, to provide uniform intensity of UV energy to the circular disk without requiring relative motion between the disk and the lamp during the curing process.



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**A SPIRAL-SHAPED LAMP FOR UV CURING OF COATINGS
AND BONDING FOR A DIGITAL VERSATILE DISK (DVD)
OR COMPACT DISK (CD)**

Cross-reference to Related Application

This application claims priority from provisional application serial no. 60/107,057, filed November 4, 1998, which is incorporated herein by reference.

Background of the Invention

The manufacturing of compact disks (CDs) and digital versatile (or video) disks (DVDs) for computer and video applications can include a number of processes, such as bonding in the case of DVDs and overcoat curing in either case, in which pulsed ultraviolet (UV) light can be used in the manufacturing process. The UV light source for providing the pulsed UV energy may be an arc lamp filled with xenon gas, thus generating significant UV energy.

It is known that a lamp with a linear elongated lamp shroud or tube can be used to generate the UV light energy for processing such disks. The use of such an elongated lamp requires relative motion of the lamp with respect to the circular disk during manufacture in order to expose the disk to the UV energy in a uniform manner.

Summary of the Invention

According to the present invention, a lamp with at least one circular turn, and preferable in a spiral configuration, is used for disk manufacturing processes that utilize pulse UV light to provide a uniform intensity of UV energy to the circular disk, without requiring relative motion between the disk and the lamp during the processing (although there would be relative motion when the disk is brought to a processing station that has the UV light). The invention thus includes a system for processing a CD or DVD including a spiral lamp, and a method for curing a CD or DVD with a spiral lamp. (For simplicity, such a video or computer disk will be

referred to generally here as a DVD.)

A contoured reflector can be provided to increase the intensity of the UV energy onto the disk surface and to make it more uniform. Another mirror can be used to help direct energy to the edge of the DVD for edge curing, as it has been found that this is an area that may not be sufficiently cured, especially in DVDs here two sides are bonded together. The mirrors and reflectors thus can reflect and diffuse the UV energy more uniformly across the disk surface and direct the energy where desired.

The lamp can have one or more turns lying in one plane parallel to the workpiece, or the lamp can have turns in different planes parallel to the workpiece. Alternatively, the lamp can be in two or more parts with an inner ring or spiral and a separate outer ring or spiral, which may or may not be in the same horizontal plane as the inner ring. The different planes can be employed to help provide uniformity and to make sure a sufficient amount of energy gets to the edge and periphery.

The spiral lamp improves edge curing while also minimizing thermal buildup. The use of a spiral also avoids the need to move the DVD relative to the lamp during processing. Other features and advantages will become apparent from the following detailed description, drawings, and claims.

Brief Description of the Drawings

Figs. 1 and 2 are a plan view and a side view of a spiral lamp according to the present invention.

Fig. 3 is a part side view, part cross-sectional view of a lamp, a workpiece, a reflector, and another mirror.

Fig. 4 is a cross-sectional view of a lamp according to another embodiment of the invention.

Description of Preferred Embodiments

Referring to Figs. 1 and 2, a spiral-shaped lamp 10 is used for curing a CD or DVD (again, such computer and video disks are referred to here collectively and generally as DVDs) during manufacture, such as when two parts of the DVD are bonded together, or when an overcoat (e.g., graphics on a disk) is to be cured. UV light is useful in such processes for providing curing of a bonding agent or an overcoat without providing excessive heat, a known benefit of pulsed light. Lamp 10 has an anode end 12 and a cathode end 14 for connection to an energy supply.

As shown in Fig. 1, lamp 10 is shaped in a spiral and is centered over the DVD in such a way that it provides minimal energy in the center of the disk where there is a hole and an unrecorded area, but more energy over the rest of the DVD. The spiral shape continues to the outer diameter of the disk area. Fig. 1 shows a total of two turns, although a single ring would be possible and more turns could be used. In addition, it would be possible to have concentric rings that do not form a single monolithic lamp unit. The spiral or other circular shape improves uniformity of the applied light as compared to a linear lamp.

In a preferred embodiment, the diameter of the lamp, from cathode end 14 to an opposite side of the lamp can range from about 4 to 6 inches, a suitable diameter for use in curing a DVD, which is about 4.75 inches. In one embodiment, the lamp has a greater diameter than the DVD to help promote curing at the edge, although the diameter may be less. The lamp could also have energy providing portions in different parallel planes relative to the workpiece.

Referring to Fig. 3, lamp 10 is shown over a DVD 18. Over lamp 10 is a contoured mirror 20 preferably configured so that the energy that is provided to the DVD is substantially uniform over the whole surface while providing little energy in the center where the DVD has a hole. The exact contour can be determined as needed to obtain the desired uniform energy on the DVD.

Another mirror 22 can also be provided to help direct energy to the edge of the DVD as shown along path 24, thus providing additional energy to ensure curing at the edge.

Referring to Fig. 4, a lamp 30 can have a first ring 32 and a second ring 34 (and possibly additional rings) that lie in different planes in a direction parallel to a workpiece 36. Rings 32 and 34 can be spaced apart and energized separately, or they can be connected like a spiral in a manner as shown in Figs. 1 and 2. The reflectors and mirror as in Fig. 3 can also be provided. This configuration can be desirable for ensuring sufficient energy at the periphery of the DVD.

As indicated above, it is known in the art that DVDs can be cured with pulsed UV light, and thus one of skill can establish parameters for operation, such as energy, energy density, pulse width, pulse time, etc. based on the materials used to make the disk, the process to be performed, and the other factors, such as a particular adhesive that may be used.

Having described certain embodiments of the present invention, it should be apparent that modifications can be made without departing from the scope of the appended claims.

What is claimed is:

Claims

1. A system for processing a DVD comprising a pulsed lamp for directing pulse light to the DVD, the lamp having a configuration with at least one circular turn.

2. The system of claim 3, wherein the lamp is a spiral with at least two turns.

3. The system of claim 2, further comprising a contoured reflector positioned to reflect light from the lamp to the DVD, the reflector being configured to provide less light to the center of the DVD and more light to the periphery.

4. The system of claim 1, further comprising a contoured reflector positioned to reflect light from the lamp to the DVD, the reflector being configured to provide less light to the center of the DVD and more light to the periphery.

5. The system of claim 1, wherein the lamp had a diameter greater than that of the DVD.

6. The system of claim 3, wherein the lamp had a diameter greater than that of the DVD.

7. The system of claim 6, wherein the lamp had a diameter greater than that of the DVD.

8. The system of claim 1, wherein the lamp had a diameter less than that of the DVD.

9. The system of claim 3, wherein the lamp had a diameter less than that

of the DVD.

10. The system of claim 6, wherein the lamp had a diameter less than that of the DVD.

11. The system of claim 1, wherein the DVD lies in a first plane, and the lamp has first and second rings, each in a different plane parallel to the DVD.

12. The system of claim 4, wherein the DVD lies in a first plane, and the lamp has first and second rings, each in a different plane parallel to the DVD.

13. The system of claim 8, wherein the DVD lies in a first plane, and the lamp has first and second rings, each in a different plane parallel to the DVD.

14. The system of claim 11, wherein the first and second rings are part of a spiral.

15. The system of claim 11, wherein the first and second rings are separated and not part of a single lamp enclosure.

16. The system of claim 14, wherein the second ring is positioned closer to the DVD.

17. The system of claim 15, wherein the second ring is positioned closer to the DVD.

18. A method for curing a DVD comprising curing the DVD with a pulsed UV lamp having at least one circular turn.

19. The method of claim 18, wherein the spiral has at least two turns.

20. The method of claim 18, wherein the method includes one of curing an overcoat or curing an adhesive between parts of the DVD.

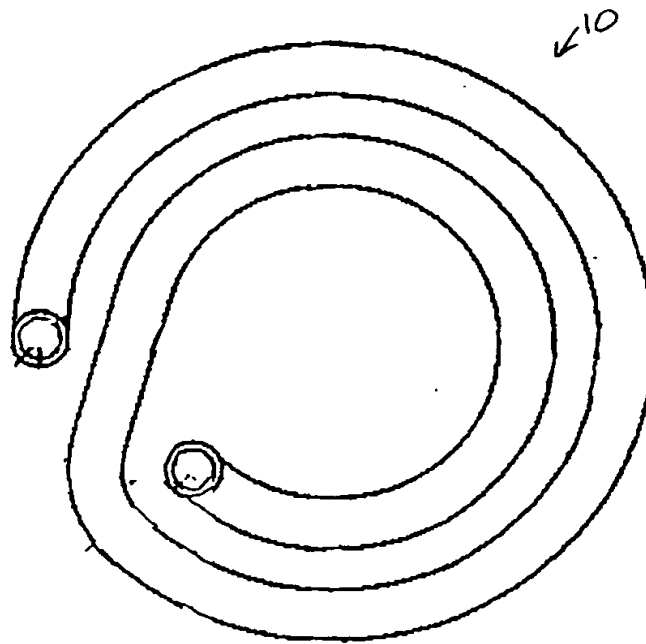


FIG. 1

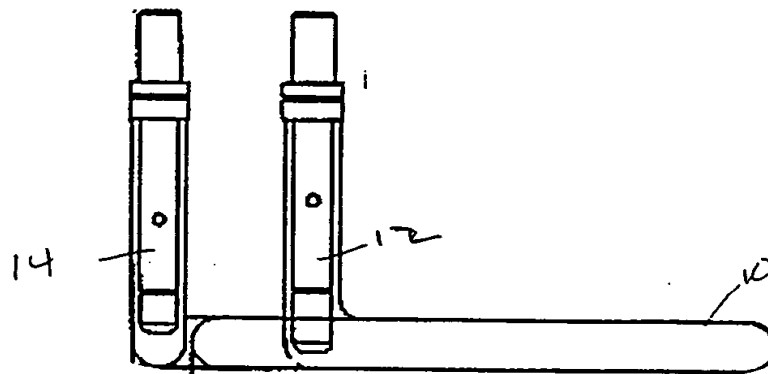


FIG. 2

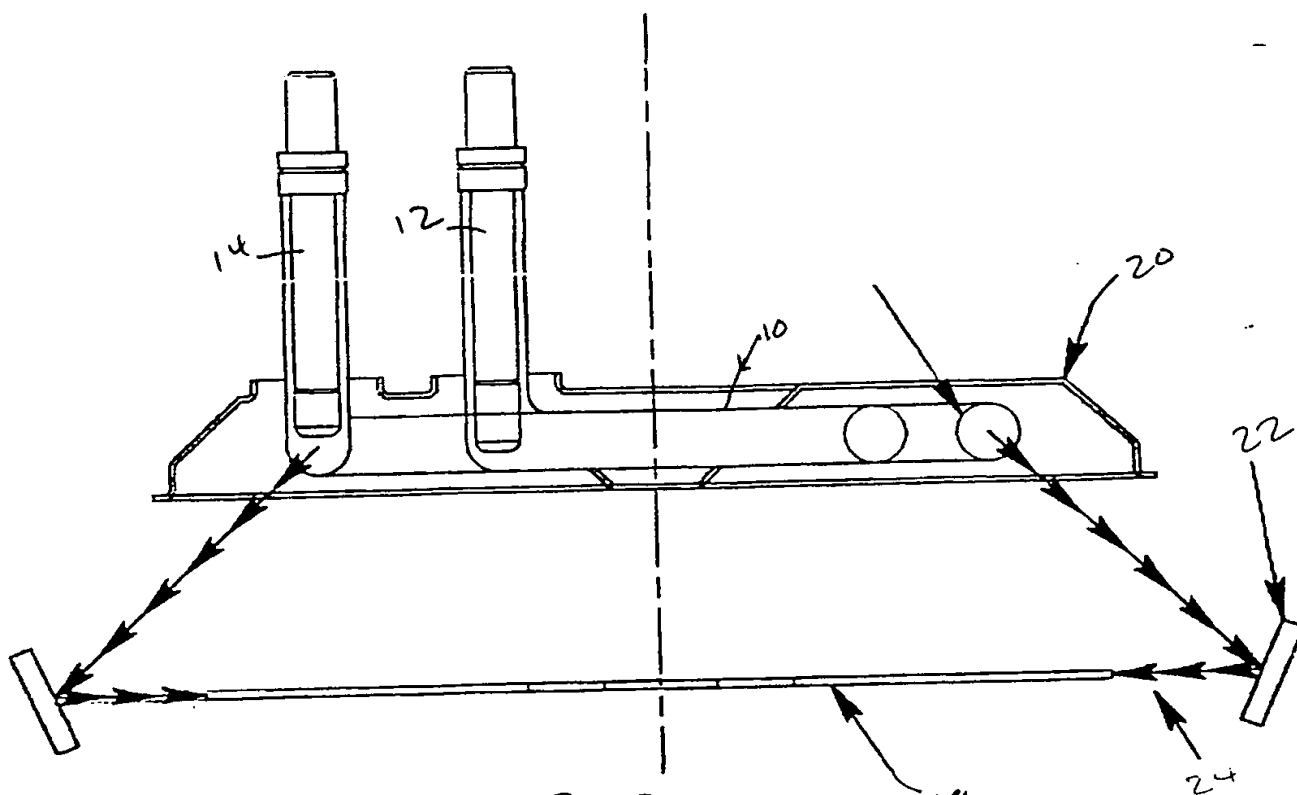


FIG. 3

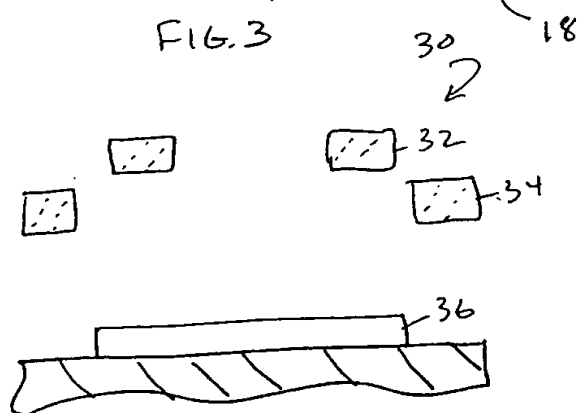


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/26188

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : B32B 31/28; G01J 1/08

US CL : Please See Extra Sheet.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : Please See Extra Sheet.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

East Search: BRS and IS&R

West search

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y ----- A	US 6,017,603 A (Tokuda et al.) 25 January 2000 (25.01.00) Claim 1 and col. 10, lines 1-5	1, 18 ----- 20
Y ----- A	US 5,569,928 A (Lee et al.) 29 October 1996 (29.10.96) Figs. 1 and 2, col. 3, lines 9-12 and 23-29.	1, 18 ----- 11-13,15-17
A	US 5,708,324 A (Anandan et al.) 13 January 1998 (13.01.98) Fig. 2A, Col. 2, lines 26-30, and claim 1	2-10, 14, & 19

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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* "A" document defining the general state of the art which is not considered to be of particular relevance	* "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US99/26188

A. CLASSIFICATION OF SUBJECT MATTER:

US CL :

250/504R, 504H, 493.1;

313/484;

428/64.2

B. FIELDS SEARCHED

Minimum documentation searched

Classification System: U.S.

250/504R, 504H, 493.1;

313/484;

428/64.2

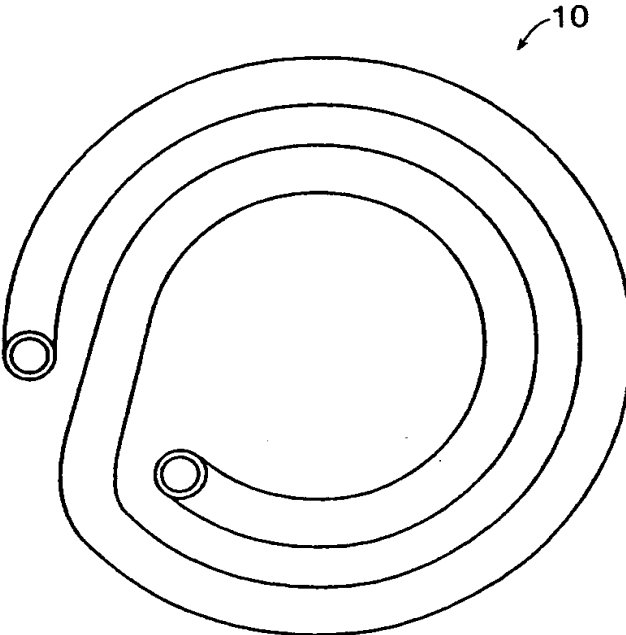
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(21) International Application Number: PCT/US99/26188 (22) International Filing Date: 4 November 1999 (04.11.99) (30) Priority Data: 60/107,057 4 November 1998 (04.11.98) US (63) Related by Continuation (CON) or Continuation-in-Part (CIP) to Earlier Application US 60/107,057 (CIP) Filed on 4 November 1998 (04.11.98) (71) Applicant (for all designated States except US): XENON CORPORATION [US/US]; 20 Commerce Way, Woburn, MA 01801 (US). (72) Inventor; and (75) Inventor/Applicant (for US only): PANICO, Richard, C. [US/US]; Medford, MA 02155 (US). (74) Agents: DIENER, Michael, A. et al.; Hale and Dorr LLP, 60 State Street, Boston, MA 02109 (US).	(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>	
(54) Title: A SPIRAL-SHAPED LAMP FOR UV CURING OF COATINGS AND BONDING FOR A DIGITAL VERSATILE DISK (DVD) OR COMPACT DISK (CD)		
(57) Abstract <p>A spiral-shaped lamp (10) is used for disk manufacturing processes, such as curing of coating or bonding, to provide uniform intensity of UV energy to the circular disk without requiring relative motion between the disk and the lamp during the curing process.</p> <div style="text-align: right; margin-right: 100px;">  </div>		

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**A SPIRAL-SHAPED LAMP FOR UV CURING OF COATINGS
AND BONDING FOR A DIGITAL VERSATILE DISK (DVD)
OR COMPACT DISK (CD)**

Cross-reference to Related Application

This application claims priority from provisional application serial no. 60/107,057, filed November 4, 1998, which is incorporated herein by reference.

Background of the Invention

The manufacturing of compact disks (CDs) and digital versatile (or video) disks (DVDs) for computer and video applications can include a number of processes, such as bonding in the case of DVDs and overcoat curing in either case, in which pulsed ultraviolet (UV) light can be used in the manufacturing process. The UV light source for providing the pulsed UV energy may be an arc lamp filled with xenon gas, thus generating significant UV energy.

It is known that a lamp with a linear elongated lamp shroud or tube can be used to generate the UV light energy for processing such disks. The use of such an elongated lamp requires relative motion of the lamp with respect to the circular disk during manufacture in order to expose the disk to the UV energy in a uniform manner.

Summary of the Invention

According to the present invention, a lamp with at least one circular turn, and preferable in a spiral configuration, is used for disk manufacturing processes that utilize pulse UV light to provide a uniform intensity of UV energy to the circular disk, without requiring relative motion between the disk and the lamp during the processing (although there would be relative motion when the disk is brought to a processing station that has the UV light). The invention thus includes a system for processing a CD or DVD including a spiral lamp, and a method for curing a CD or DVD with a spiral lamp. (For simplicity, such a video or computer disk will be

referred to generally here as a DVD.)

A contoured reflector can be provided to increase the intensity of the UV energy onto the disk surface and to make it more uniform. Another mirror can be used to help direct energy to the edge of the DVD for edge curing, as it has been found that this is an area that may not be sufficiently cured, especially in DVDs here two sides are bonded together. The mirrors and reflectors thus can reflect and diffuse the UV energy more uniformly across the disk surface and direct the energy where desired.

The lamp can have one or more turns lying in one plane parallel to the workpiece, or the lamp can have turns in different planes parallel to the workpiece. Alternatively, the lamp can be in two or more parts with an inner ring or spiral and a separate outer ring or spiral, which may or may not be in the same horizontal plane as the inner ring. The different planes can be employed to help provide uniformity and to make sure a sufficient amount of energy gets to the edge and periphery.

The spiral lamp improves edge curing while also minimizing thermal buildup. The use of a spiral also avoids the need to move the DVD relative to the lamp during processing. Other features and advantages will become apparent from the following detailed description, drawings, and claims.

Brief Description of the Drawings

Figs. 1 and 2 are a plan view and a side view of a spiral lamp according to the present invention.

Fig. 3 is a part side view, part cross-sectional view of a lamp, a workpiece, a reflector, and another mirror.

Fig. 4 is a cross-sectional view of a lamp according to another embodiment of the invention.

Description of Preferred Embodiments

Referring to Figs. 1 and 2, a spiral-shaped lamp 10 is used for curing a CD or DVD (again, such computer and video disks are referred to here collectively and generally as DVDs) during manufacture, such as when two parts of the DVD are bonded together, or when an overcoat (e.g., graphics on a disk) is to be cured. UV light is useful in such processes for providing curing of a bonding agent or an overcoat without providing excessive heat, a known benefit of pulsed light. Lamp 10 has an anode end 12 and a cathode end 14 for connection to an energy supply.

As shown in Fig. 1, lamp 10 is shaped in a spiral and is centered over the DVD in such a way that it provides minimal energy in the center of the disk where there is a hole and an unrecorded area, but more energy over the rest of the DVD. The spiral shape continues to the outer diameter of the disk area. Fig. 1 shows a total of two turns, although a single ring would be possible and more turns could be used. In addition, it would be possible to have concentric rings that do not form a single monolithic lamp unit. The spiral or other circular shape improves uniformity of the applied light as compared to a linear lamp.

In a preferred embodiment, the diameter of the lamp, from cathode end 14 to an opposite side of the lamp can range from about 4 to 6 inches, a suitable diameter for use in curing a DVD, which is about 4.75 inches. In one embodiment, the lamp has a greater diameter than the DVD to help promote curing at the edge, although the diameter may be less. The lamp could also have energy providing portions in different parallel planes relative to the workpiece.

Referring to Fig. 3, lamp 10 is shown over a DVD 18. Over lamp 10 is a contoured mirror 20 preferably configured so that the energy that is provided to the DVD is substantially uniform over the whole surface while providing little energy in the center where the DVD has a hole. The exact contour can be determined as needed to obtain the desired uniform energy on the DVD.

Another mirror 22 can also be provided to help direct energy to the edge of the DVD as shown along path 24, thus providing additional energy to ensure curing at the edge.

Referring to Fig. 4, a lamp 30 can have a first ring 32 and a second ring 34 (and possibly additional rings) that lie in different planes in a direction parallel to a workpiece 36. Rings 32 and 34 can be spaced apart and energized separately, or they can be connected like a spiral in a manner as shown in Figs. 1 and 2. The reflectors and mirror as in Fig. 3 can also be provided. This configuration can be desirable for ensuring sufficient energy at the periphery of the DVD.

As indicated above, it is known in the art that DVDs can be cured with pulsed UV light, and thus one of skill can establish parameters for operation, such as energy, energy density, pulse width, pulse time, etc. based on the materials used to make the disk, the process to be performed, and the other factors, such as a particular adhesive that may be used.

Having described certain embodiments of the present invention, it should be apparent that modifications can be made without departing from the scope of the appended claims.

What is claimed is:

Claims

1. A system for processing a DVD comprising a pulsed lamp for directing pulse light to the DVD, the lamp having a configuration with at least one circular turn.
2. The system of claim 3, wherein the lamp is a spiral with at least two turns.
3. The system of claim 2, further comprising a contoured reflector positioned to reflect light from the lamp to the DVD, the reflector being configured to provide less light to the center of the DVD and more light to the periphery.
4. The system of claim 1, further comprising a contoured reflector positioned to reflect light from the lamp to the DVD, the reflector being configured to provide less light to the center of the DVD and more light to the periphery.
5. The system of claim 1, wherein the lamp had a diameter greater than that of the DVD.
6. The system of claim 3, wherein the lamp had a diameter greater than that of the DVD.
7. The system of claim 6, wherein the lamp had a diameter greater than that of the DVD.
8. The system of claim 1, wherein the lamp had a diameter less than that of the DVD.
9. The system of claim 3, wherein the lamp had a diameter less than that

of the DVD.

10. The system of claim 6, wherein the lamp had a diameter less than that of the DVD.

11. The system of claim 1, wherein the DVD lies in a first plane, and the lamp has first and second rings, each in a different plane parallel to the DVD.

12. The system of claim 4, wherein the DVD lies in a first plane, and the lamp has first and second rings, each in a different plane parallel to the DVD.

13. The system of claim 8, wherein the DVD lies in a first plane, and the lamp has first and second rings, each in a different plane parallel to the DVD.

14. The system of claim 11, wherein the first and second rings are part of a spiral.

15. The system of claim 11, wherein the first and second rings are separated and not part of a single lamp enclosure.

16. The system of claim 14, wherein the second ring is positioned closer to the DVD.

17. The system of claim 15, wherein the second ring is positioned closer to the DVD.

18. A method for curing a DVD comprising curing the DVD with a pulsed UV lamp having at least one circular turn.

19. The method of claim 18, wherein the spiral has at least two turns.

20. The method of claim 18, wherein the method includes one of curing an overcoat or curing an adhesive between parts of the DVD.

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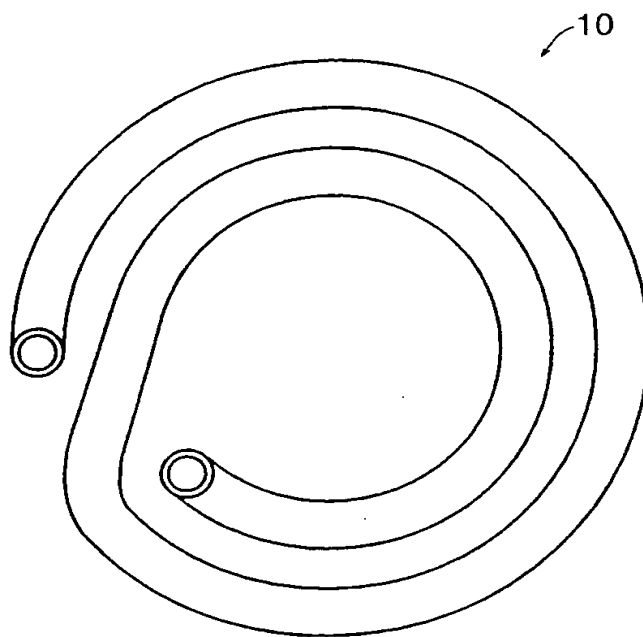


FIG. 1

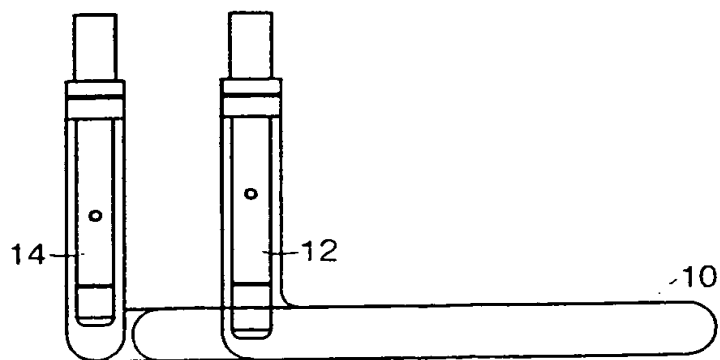


FIG. 2

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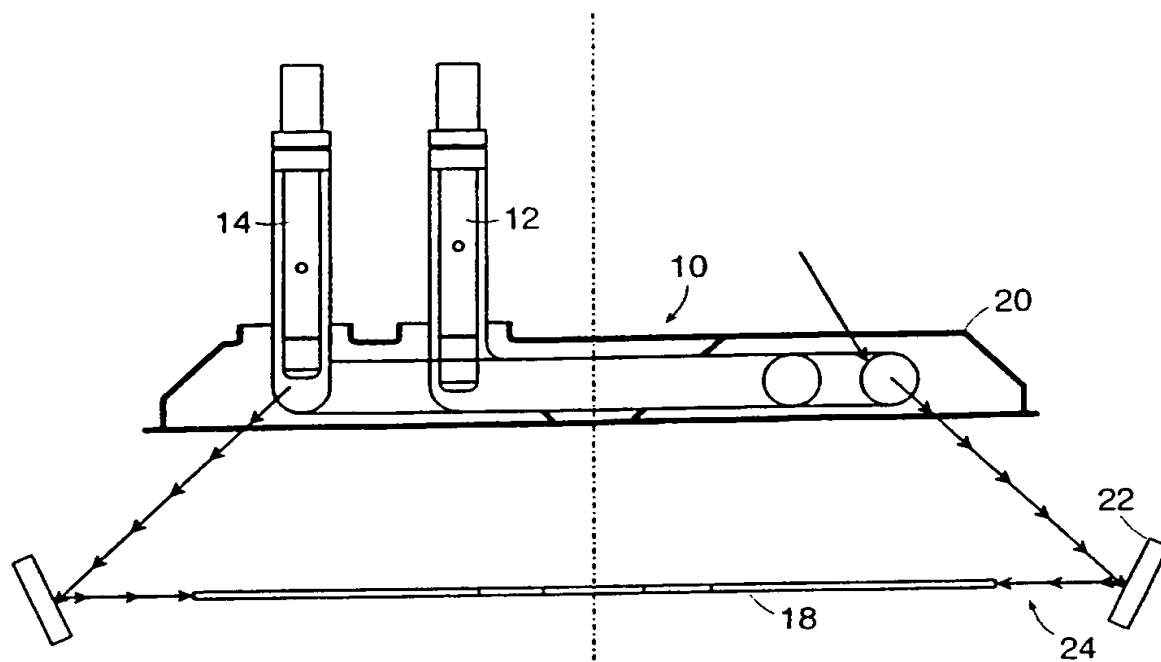


FIG. 3

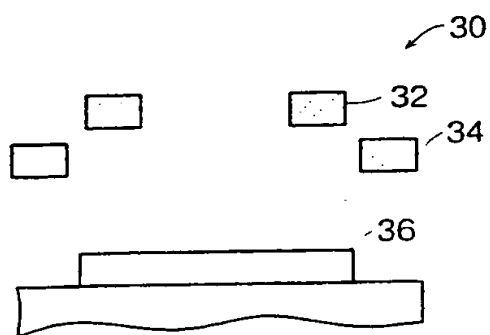


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/26188

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : B32B 31/28; G01J 1/08
US CL : Please See Extra Sheet.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : Please See Extra Sheet.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

East Search: BRS and IS&R

West search

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y ----- A	US 6,017,603 A (Tokuda et al.) 25 January 2000 (25.01.00) Claim 1 and col. 10, lines 1-5	1, 18 ----- 20
Y ----- A	US 5,569,928 A (Lee et al.) 29 October 1996 (29.10.96) Figs. 1 and 2, col. 3, lines 9-12 and 23-29.	1, 18 ----- 11-13, 15-17
A	US 5,708,324 A (Anandan et al.) 13 January 1998 (13.01.98) Fig. 2A, Col. 2, lines 26-30, and claim 1	2-10, 14, & 19

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	T	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

29 FEBRUARY 2000

Date of mailing of the international search report

13 APR 2000

Name and mailing address of the ISA/US
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US99/26188

A. CLASSIFICATION OF SUBJECT MATTER:

US CL :

250/504R, 504H, 493.1;

313/484;

428/64.2

B. FIELDS SEARCHED

Minimum documentation searched

Classification System: U.S.

250/504R, 504H, 493.1;

313/484;

428/64.2

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